DOCUMENT RESUME

ED 281 888 TM 870 310

AUTHOR Stage, Frances K.
TITLE University Attrition: LISREL with Logistic Regression for the Persistence Criterion.
PUB DATE Apr 87
NOTE 32p.; Paper presented at the Annual Meeting of the American Educational Research Association (Washington, DC, April 20-24, 1987).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Academic Persistence; *College Freshmen; Family Characteristics; Higher Education; Hypothesis Testing; Institutional Role; Longitudinal Studies; *Path Analysis; Racial Differences; *Regression (Statistics); *Sex Differences; Social Integration; Socioeconomic Background; Student Educational Objectives
IDENTIFIERS Commitment; *LISREL Computer Program; *Tinto Theory

ABSTRACT

The purpose of this longitudinal study was to examine associations among background characteristics, commitment levels, institutional involvements, and persistence for male and female university students. Data were collected from college records and surveys completed by 316 university freshmen at the beginning of and 10 weeks into the 1984 fall semester and at the beginning of the 1985 spring semester. Logistic regression analysis in conjunction with LISREL was used to analyze the data. Within LISREL, an initial model was specified using paths described in Tinto's model of college student attrition. Tinto's model consists of six key constructs linked causally: background characteristics, initial commitments, academic and social integration, later commitment, and persistence. Results reinforced Tinto's conjecture that background effects do influence persistence directly. Initial levels of institutional and goal commitments strongly influenced later levels of the same variables. For both males and females, academic and social integration positively influenced persistence. For females, academic integration, social integration and later institutional commitment were significant predictors of persistence. For males, only academic integration and social integration significantly and directly influenced persistence. (JAZ)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED281888

University Attrition: LISREL with Logistic Regression for the Persistence Criterion

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

F. K. Stage

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☒ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Frances K. Stage
Assistant Professor
Educational Leadership and Policy Studies
Indiana University

Paper presented at the annual meeting of the
American Educational Research Association
Washington, D.C.

April, 1987

TM 870 310

BEST COPY AVAILABLE

Abstract

University Attrition: LISREL with Logistic Regression for the Persistence Criterion

This study employed logistic regression used in conjunction with LISREL in a university attrition study. College records and surveys completed by first year university students at the beginning of and two months into the semester were used to operationalize key constructs within the Tinto model. The sample of 316 students was divided into male and female subgroups for analysis. Significant influential factors within the final empirical models varied between the two groups. Hypothesis testing was used to identify significant differences between models.

University Attrition: LISREL with Logistic Regression for the Persistence Criterion

The presentation of the Tinto model of college student attrition (1975) marked the pivotal point in the study of persistence. Drawing directly from Spady (1970, 1971), Tinto explicated a conceptual schema of college withdrawal which distinguished between the academic and the social dimensions of the college environment. Prior to the presentation of the model, research had been unintegrated. Researchers explored myriad individual variables in relation to persistence but did little to tie them together conceptually. The Tinto model provided structure which was used to begin to place these variables in relationship to one another in both sequence and importance.

Additionally, the Tinto model directed researchers toward new methodological techniques necessary for further advancement in understanding the persistence phenomenon. The typically used correlation and multiple regression techniques were not adequate to the task of describing relationships within the model. Tinto suggested the use of longitudinal data collection and path analysis techniques to specify order and causality among the variables.

Along these two dimensions then, conceptual and methodological, persistence study changed abruptly. And Tinto has influenced directly nearly every study since 1975 including other major persistence models (Bean, 1980, 1985). However,

though persistence study has come far since the introduction of the Tinto model, researchers have reached a roadblock. There is agreement that the model as described by Tinto explains the attrition/persistence process in general. However, some aspects of the model are more important than others for individual students. Thus far researchers have been unable to pinpoint which experiences are the most important facilitators of persistence for particular types of students. In attempting to address this problem progress has been made by examining subgroups of students such as those determined by gender or by ethnicity.

Recent research based upon Spady's (1970, 1971) and Tinto's (1975) longitudinal process models of attrition has explored links among the background characteristics of students, the social and academic integration of those students within the college and university system, and ultimately their persistence or withdrawal. This research (Bean, 1980, 1985; Pascarella and Terenzini, 1979, 1980, 1983) has explained modest proportions of the variance in attrition. By disaggregating analysis according to groups that were hypothesized to be similar such as students of the same gender (Pascarella and Terenzini, 1983), students who had chosen to attend various types of institutions (Pascarella and Chapman, 1983) or students at different levels of college

(Bean, 1985) researchers found differences in "experience patterns" within final empirical models.

Researchers working within the Tinto framework have consistently found what has been termed a compensatory relationship among variables (Pascarella and Terenzini, 1983; Pascarella and Chapman, 1983; Terenzini and Pascarella, 1980). That is, academic integration has its strongest positive influence on persistence at relatively low levels of social integration. As the level of social integration increases, the positive influence of academic integration on persistence becomes less pronounced. The same compensatory relationship is true for the influence of social integration. Similar relationships exist between commitment to the goal of graduation and commitment to the institution. Attempts to further explain these relationships by disaggregating analyses using demographic differences among students have been relatively unsuccessful.

Pascarella and Terenzini (1979) found differences between male and female subgroups in path analyses designed to determine causes of attrition. For men commitments, discussion of intellectual matters with faculty, faculty concern for students and GPA were important predictors. For women peer group relationships, faculty interactions and faculty contacts for program information all significantly predicted persistence.

The purpose of this study was to examine associations among background characteristics, commitment levels, institutional

involvements and persistence for male and female university students.

The Tinto Model

Tinto viewed the attrition process as a series of changing commitments and experiences affecting students' integration and, ultimately, decisions to withdraw from or to continue in the institution. The underlying assumption of the model was that students enter an institution with certain specifiable background characteristics and a measurable level of initial commitments. Within the institution, students engage in interactions with the environment during which they become integrated into the system both academically and socially.

In addition to these clearly distinguished realms of activity, academic and social, the model incorporated such factors as family background, individual attributes and pre-college schooling. The individual's commitments to goals were included in the model to help specify the psychological orientations the individual brought to the college setting. Interactions between individuals and the academic and social systems of their college continually acted to modify goals and institutional commitments in ways which led to persistence or to varying forms of dropout. Theoretically, for two students of similar backgrounds and the same levels of initial commitments, a higher degree of integration into the system for one would mean greater subsequent commitment to the institution and to the goal of college completion.

Typically persistence researchers employed path analysis to investigate causal relationships among variables. Such research was criticized because regression-type analysis (upon which path analysis relied) used in this type of study was fraught with assumption violations. For these reasons LISREL, a more versatile analytic technique, and logistic regression were selected for this study.

Method

Design and Sample

The study was conducted at a major public university in the southwest. The typical fall to spring semester attrition rate at the focal institution varied from 10-12 percent. These rates are similar to the freshman to sophomore year attrition rates of other persistence research [Bean (1985), 10.0%; Pascarella and Terenzini (1980), 6.2%; Pascarella and Terenzini (1983) 11.64%]. The rate in this semester to semester study (9%) provided a similar amount of variance in the sample.

The study design was longitudinal with survey data collected at the beginning and ten weeks into the fall semester of 1984 and at the beginning of the spring semester of 1985. All non-transfer students at the university were required to take Freshman Composition, Advanced Freshman Composition or to "test out" of Freshman Composition. A random sample was taken of English composition classes at the university. In order to sample students as soon as possible in the fall semester, surveys were distributed in the selected sections during the first two

weeks of classes. Additionally, a random sample was taken of students who had "tested out" of Freshman Composition. These students were surveyed by mail.

The first survey elicited responses to motivation questions, institutional and goal commitment scales, and demographic information. In approximately ten weeks students were surveyed again using the Institutional Integration Scales (Pascarella and Terenzini, 1983). Finally, responses were matched with institutional records to determine GPA achieved, hours earned and registration for the following semester. Seventy-one point two percent (n=319) of the students in the classrooms and fifty-seven point three percent (n=4) of those surveyed by mail completed both surveys and were successfully matched to the institutional data base for an overall response rate of seventy-one percent (n=323).

Variables

The Tinto model consists of six key constructs linked causally: background characteristics, initial commitments, academic integration, social integration, later commitments and persistence.

Background characteristics. This construct was operationalized through responses received on the initial survey received early in the fall semester. Students were asked age, gender, ethnicity, mother's education level and father's education level (See Table 1).

TABLE I

Measurement of Variables

Background Characteristics:

Mother's Education: 1 = < 12 years
2 = high school graduate
3 = 2 years college
4 = Bachelors degree
5 = Graduate or Professional School

Father's Education: 1 = < 12 years
2 = high school graduate
3 = 2 years college
4 = Bachelors degree
5 = Graduate or Professional School

Age

Sex: 1 = Female
2 = Male

Ethnicity: 0 = American Indian, Black, Chicano
1 = Anglo, Asian,Other

Goal Commitment (Time 1):
mean score on 3 items such as
It is important for me to graduate from college.
I have no idea at all what I want to major in.

Institutional Commitment (Time 1):
mean score on 5 items such as
It is imporant for me to be enrolled at Arizona State University.
It is likely that I will register at this University next fall.

Academic Integration:
Academic Development - mean score on 7 items such as -
I am satisfied with the extent of my intellectual development since enrolling in this university.
My academic experience has had a positive influence on my intellectual growth and interest in ideas.

Faculty Concern - mean score on 5 items such as -
Few of the faculty members I have had contact with are generally interested in students.
Few of the faculty members I have had are genuinely outstanding or superior teachers.

Table 1 (continued)

Academic Integration (continued)

GPA
Hours earned
Hours spent engaged in academic activities (band, theatre, publications, professional clubs, etc.)

Social Integration:
Peer Group Relations - mean score on 7 items such as -
Since coming to this university I have developed close personal relationships with other students.
The student friendships I have developed at this university have been personally satisfying.

Informal Faculty Relations - mean score on 5 items such as -
My nonclassroom interactions with faculty have had a positive influence on my personal growth, values and attitudes.
My nonclassroom interactions with faculty have had a positive influence on my career goals and aspirations.

Residency: 1 = off campus
2 = off campus with other students
3 = on campus

Campus Employment: 1 = yes
2 = no

Hours spent engaged in social activities (intramurals, sororities, fraternities, social clubs, residence hall activities, etc.)
Hours spent engaged in intercollegiate athletics

Institutional Commitment (Time 2): same measures as shown on previous page
Goal Commitment (Time 2): same measures as shown on previous page

Persistence: 0 = not registered for spring semester
1 = registered for spring semester

Initial commitments. Measures of initial goal and institutional commitments were taken in the first survey using the Institutional Integration Scales (IIS) (Pascarella & Terenzini, 1983) (See Table 1).

Academic Integration. This construct, measured with the second survey instrument (two months into the semester), was designed to quantify academic experiences on campus. There were five indicator items:

1) the Academic Development Scale [IIS, reported alpha reliability, .72 (Pascarella & Terenzini, 1983)]
2) the Faculty Concern Scale (IIS, a=.77)
3) grade point average (GPA)
4) credits earned during the first semester
5) hours spent engaged in academic extra-curricular activities such as band, theatre, professional organizations, etc. (See Table 1).

Social Integration. This construct, also measured with the second survey instrument, was composed of six items:

1) the Peer Group Relations Scale (IIS, a=.84)
2) the Informal Faculty Relations Scale (IIS, a=.83)
3) residency
4) campus employment
5) hours spent engaged in social activities
6) hours spent engaged in intercollegiate athletics (See Table 1).

Later Commitments. Repeated measures of institutional and goal commitments were taken with the second survey.

Persistence. Whether or not registered for the spring semester.

Statistical Analysis of the Model

Persistence researchers' use of regression analysis with a highly skewed dependent variable has been criticized. In a typical persistence study the dropout rate ranges from 5 to 15%. Using such a variable as the criterion in a regression equation violates the assumption that variables are normally distributed. To avoid this and other assumption violations, LISREL, a causal analysis technique, was used to analyze the relationships among the constructs within the Tinto model. Effects on the dichotomous criterion, persistence, were analyzed using logistic regression.

LISREL, like path analysis, provides estimates of unknown coefficients in a set of linear structural equations. In its most general form the LISREL model assumes a specified causal structure among a set of latent variables or hypothetical constructs, some of which are dependent or endogenous and others of which are independent or exogenous.

Actual analysis consists of two parts: the measurement model and the structural equations model. The measurement model specifies how the latent variables are measured in terms of the observed variables. The structural equations model specifies the causal relationships among latent variables.

In this study the measurement model for the observed y can be written:

$$y = \Lambda_y \eta + E$$

where the observed y_i are determined by a multiple (Λy_i) times the latent construct (η) plus error (E_i). For example, in this study the set of measurement variables, Academic Development, Faculty Concern, GPA, Hours Earned and Hours engaged in Academic Activities, can each be expressed as some multiplier times the latent construct Academic Integration (β) plus some degree of error.

The structural equations model specifies the causal relationships among latent variables (η). In this application there are six latent constructs: Initial Goal Commitment, Initial Institutional Commitment, Academic Integration, Social Integration, Later Goal Commitment and Later Institutional Commitment.

The general model consists of exogenous and endogenous variables. Exogenous variables are determined outside the model and are not explained within the LISREL analysis. In this case exogenous variables are Mother's education, Father's education, Age, Gender, and Ethnicity. Endogenous variables are those whose value may be determined through the model. The six latent constructs, Initial Goal Commitment, Initial Institutional Commitment, Academic Integration, Social Integration, Later Goal Commitment and Later Institutional Commitment, are the endogenous variables which will be examined with the model.

Upon application of LISREL to any given set of data theoretically motivated constraints may be placed upon specific portions of the model to test hypotheses regarding relationships among variables in a model or relationships between models for different subgroups. By constraining factors (restricting them to certain values) and then comparing the chi-square for the unconstrained model one can determine the statistical significance resulting from the constraint (Benin & Johnson, 1984; Wolfle, 1985).

The resulting LISREL model may be evaluated using the chi-square statistic with its associated degrees of freedom and probability level, the goodness-of-fit index and the root mean square residual. The chi-square is an evaluation of fit of the given data to the resulting model. A high ratio of chi-square to degrees of freedom (larger than three) indicates a poor fit. The statistic is affected by sample size, however, and for very large sample sizes a model may be rejected even when it fits the data well.

The Causal Analysis

Within LISREL, an initial model was specified using paths described in Tinto's model. The models for the male and female subgroups were run simultaneously. A series of hypotheses were posed regarding relationships within the models. These hypotheses were developed based on previous research results and literature on student behavior. The tests were conducted by comparing the chi-square statistic of a given model with the

chi-square statistic of a slightly altered model. In this way a statistical test determined whether a particular path actually made a significant contribution to the fit of the model to the data (Wolfle, 1985).

Table 2 shows the results of these tests. The first model was run with no constraints to the major paths within the model resulting in a chi-square of 468.36 with 266 degrees of freedom (df). The first step taken was to determine whether the measurement model for Academic and Social Integration could be held equal across the two subgroups. Restricting the weightings for both subgroups to be the same resulted in a chi-square of 479.30 for 275 degrees of freedom. Comparison with the first model results in a chi-square difference of 10.94 for 9 degrees of freedom, an insignificant difference. In other words the weightings on the variables which served as indicators of both Academic and Social Integration did not differ significantly between the two subgroups. For the remainder of the analysis these weightings were constrained to be equal.

Background characteristics of students have been found generally to have insignificant direct influence on later variables in the Tinto model and persistence (Pascarella & Chapman, 1983; Pascarella & Terenzini, 1980). Because effects of college experiences were the major focus here, all background characteristics' effects on later constructs in the model were held equal across the two groups. This constraint resulted in an insignificant change in the fit of the model to the data when

Table 2

Results of Hypothesis Testing of Individual Paths

Model	Description	df	x^2	Δdf	Δx^2	sig.
1	Initial Model	266	468.36			
2	Model 1 with academic and social integration measures equal, 2 vs. 1.	275	479.30	9	10.94	--
3	Model 2 with background effects equal, 3 vs. 2.	291	503.02	16	23.72	--
4	GoalCom to AcadInt held equal between groups, 4 vs. 3.	292	503.18	1	.16	--
5	InstCom to SocIInt held equal between groups, 5 vs. 4.	293	509.49	1	6.31	p<.02
6	AcadInt to GoalCom2 held equal between groups, 6 vs. 4.	293	503.94	1	.86	--
7	SocIInt to InstCom2 held equal between groups, 7 vs. 6.	294	504.49	1	.55	--

compared with the previous model. For the remainder of the analysis these paths were constrained to be equal for the two groups.

To test the effect of initial commitment upon integration into the university, first the effect of Initial Goal Commitment on Academic Integration was held constant across the groups (Model 3). The change in chi-square relative to the change in degrees of freedom indicated no significant change in the fit of the model to the data. Holding the effect of Initial Institutional Commitment on Social Integration equal across the groups (Model 4) however when compared with the previous model resulted in a significant change in the fit of the model to the data. This indicated that the effect of Initial Institutional Commitment on Social Integration was significantly different for the two subgroups. The constraint that that path be held equal across the two subgroups was dropped for the remainder of the analysis.

Finally, Academic and Social Integration's effects on later commitments were tested. First, the path between Academic Integration and Later Goal Commitment was held equal across the two groups and resulted in an insignificant change in the fit of the model to the data. Next, the effect of Social Integration on Later Institutional Commitment was held equal across the two groups and again resulted in an insignificant change in the fit of the model to the data when compared with the previous model.

Tables 3 and 4 present the standardized path coefficients and significances. Males and females did not differ in significant paths within the two separate models except in degree of significance. Father's Education and Ethnicity (positive for majority students) were significant predictors of Academic Integration. Father's Education, Age (negative) and Initial Institutional Commitment were significant predictors of Social Integration. Initial Goal Commitment was the only significant predictor of Later Goal Commitment. Later Institutional Commitment had two significant influences. Initial Institutional Commitment and Social Integration.

The Logistic Regression

The LISREL run produces weightings within the measurement model (similar to a factor analysis) which can be used to determine values for Academic Integration and Social Integration. These latent constructs were created for use in the logistic regression by using the unstandardized weightings from the final LISREL run.

Academic Integration = 1.000 * Academic Development
+ 0.686 * Faculty Concern
+ 2.737 * GPA
+ 2.255 * Hours Earned
+ 0.166 * Academic Activities

Table 3

Standardized Path Coefficients - Female Subgroup

Independent Variable	Dependent Variable: Goal Commitl	Instit. Commitl	Acad. Integ.	Social Integ.	Goal Commit2	Instit. Commit2
Mother's Ed.	.034	.058	.014	.015	0	0
Father's Ed.	.059	.032	.153*	.134*	0	0
Age	.022	.086	.033	-.103*	0	0
Ethnicity	.029	-.057	.303***	.007	0	0
Goal Commitl	0	0	.033	0	.092***	0
Inst Commitl	0	0	0	.488***	0	.257***
Acad Integ	0	0	0	0	.015	0
Social Integ	0	0	0	0	0	.048*

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 4

Standardized Path Coefficients - Male Subgroup

	Dependent Variable					
Independent Variable	Goal Commitl	Instit. Commitl	Acad. Integ.	Social Integ.	Goal Commit2	Instit. Commit2
Mother's Ed.	.034	.058	.014	.015	0	0
Father's Ed.	.059	.032	.153*	.134*	0	0
Age	.022	.086	.033	-.103*	0	0
Ethnicity	.029	-.057	.303***	.007	0	0
Goal Commitl	0	0	.033	0	.071*	0
Inst Commitl	0	0	0	.175*	0	.135***
Acad Integ	0	0	0	0	.015	0
Social Integ	0	0	0	0	0	.048*

* $p < .05$ ** $p < .01$ *** $p < .001$

Social Integration = 1.000 * Peer Relations
+ 0.343 * Faculty Interest
+ 0.263 * Other Activities
+ 0.066 * Intercollegiate Athletics
+ 0.510 * Residency
+ 0.037 * Campus Employment

In order to test the effects of the exogenous and endogenous variables on the dichotomous criterion variable persistence, a logistic stepwise regression was conducted. The probability to enter variables in to the model was for a p less than .1000 and the remove limit was set for p greater than .1500.

Pascarella and Terenzini (1979) and others have found interaction of gender and ethnicity with endogenous parts of the model to have significant effects on persistence. Therefore, four interaction terms were created for inclusion in the stepwise regression: Ethnicity by Academic Integration, Ethnicity by Social Integration, Ethnicity by Later Goal Commitment, and Ethnicity by Later Institutional Commitment. The regression was begun with all the main effects, the background characteristics and endogenous constructs, in the model. Interaction terms were entered only if they passed the enter limit for significant effect on the criterion, persistence.

Results from the logistic regression, in addition to identifying significant predictors of persistence within each subgroup, may be used to calculate odds that a student with given characteristics and experiences persists. These odds are

calculated with respect to the other variables in the equation. Table 5 lists the variables which were significant predictors of persistence, the range of the given variables, the log odds coefficient, and the probability of persisting for a unit change in the respective independent variable.

For example, for students in the Female subgroup, a change of one unit in the Academic Integration variable (with a wide range of 51) multiplied their probability of persisting by .3423 In contrast, a change of one unit in the Later Institutional Commitment variable (with a smaller range of 7.7) multiplied students probability of persisting by .2877. The combined probabilities can be used to calculate any female student's probability of persisting or dropping out. Consider two actual cases:

	Acadint	SocialInt	LatrInstcom	Ethn
Student A:	6.45	11.73	.29	Min(-1)
Student B:	42.62	6.92	3.17	Maj(1)

For student A the probability of dropping out may be computed by raising e to the calculated exponent:

P = exp (6.45 * -1.072 + 11.73 * 3.162 + .29 * -1.246 +
-1 * 6.45 * .976 + -1 * 11.73 * -3.388 + -.311)

resulting in a probability of dropping out of nearly 100%. Student A in fact did dropout. For student B the probability of dropping out may be computed by raising e to the calculated exponent:

P = exp (42.62 * -1.072 + 6.92 * 3.162 + 3.17 * -1.246 +
1 * 42.62 * .976 + 1 * 6.92 * -3.388 + -.311)

Table 5

Results of the Logistic Regression

by Subgroup

Subgroup	Independent Variable (prob)	range	log odds coeff.	exp(log odds) = prob of persist
Female	Academic Int. p<.001	51.3	-1.072	.342
	Social Int. p<.05	18.84	3.162	23.618
x^2 =44.8	Inst. Com 2 p<.001	7.71	-1.246	.288
df=179	EthnXAcadInt p<.01	.	.976	2.654
p=1.000	EthnXSocIInt p<.001	.	-3.388	.034
	Constant	.	-.311	
Male	Academic Int. p<.001	51.6	-.140	.869
	Social Int. p<.01	14.5	-.965	.381
x^2 =34.4	Constant	.	7.533	xxxxx
df=125				
p=1.000				

resulting in a probability of dropping out of .0018. Student B did not drop out.

Results by Subgroup

Combining the results of the LISREL analyses with the results of the logistic regressions provides a structural pattern within the Tinto model for each subgroup (Figures 1 and 2). Only significant paths are depicted and highly significant paths are indicated with an asterix ($p < .01$). For both subgroups Father's Education (positive) was a significant predictor of both Academic and Social Integration. Age (negative) was a significant predictor of Social Integration. Ethnicity (negative for minorities) was a significant predictor of Academic Integration.

For students within the Female subgroup Initial Institutional Commitment was a significant predictor of Social Integration and Later Institutional Commitment. Social Integration was a significant predictor of Later Institutional Commitment and Initial Goal Commitment was a significant predictor of Later Goal Commitment. Academic Integration, Social Integration and Later Institutional Commitment were significant predictors of persistence. Interaction terms indicated that minority students at lower levels of Academic Integration were more likely to drop out. However, minority students at higher levels of Social Integration were more likely to drop out.

For students in the Male subgroup initial and later measures of both Institutional and Goal Commitments were significantly

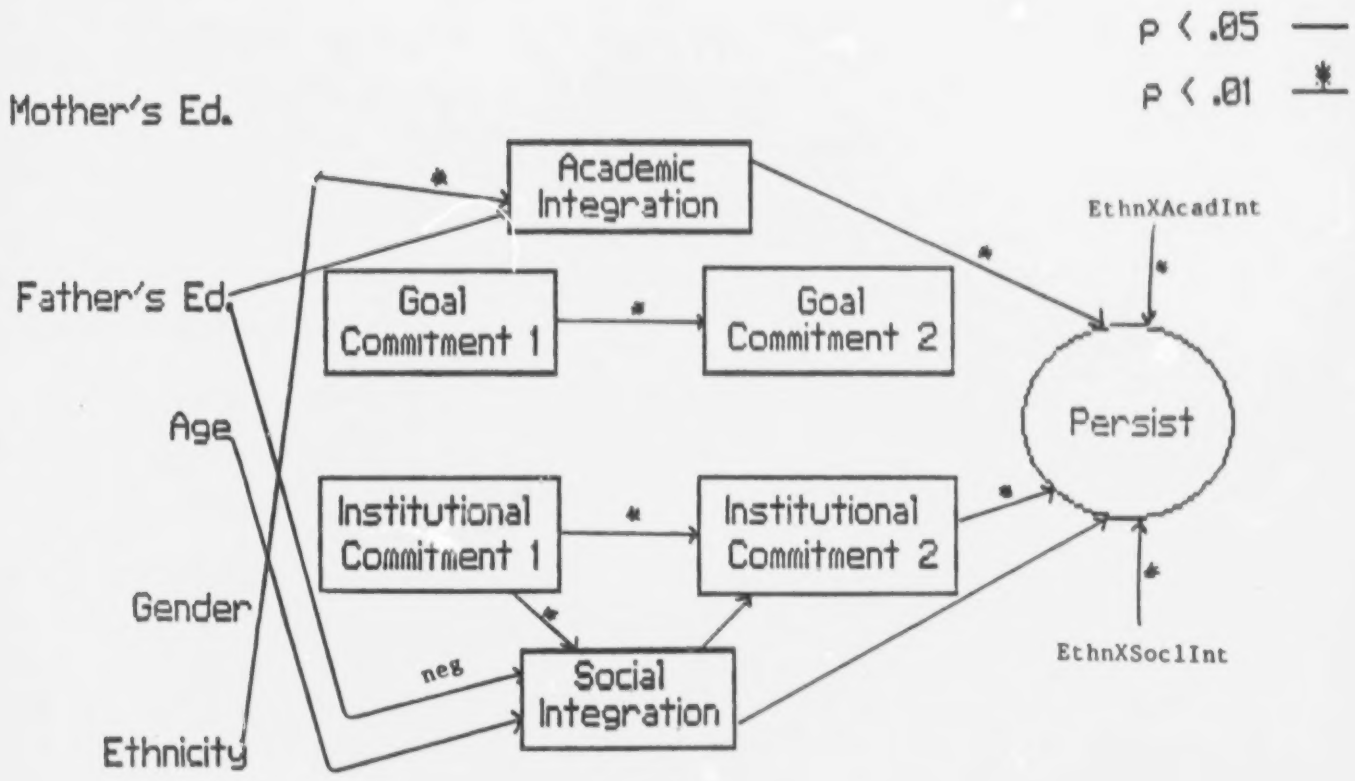

Figure 1 Final Model for the Female Subgroup

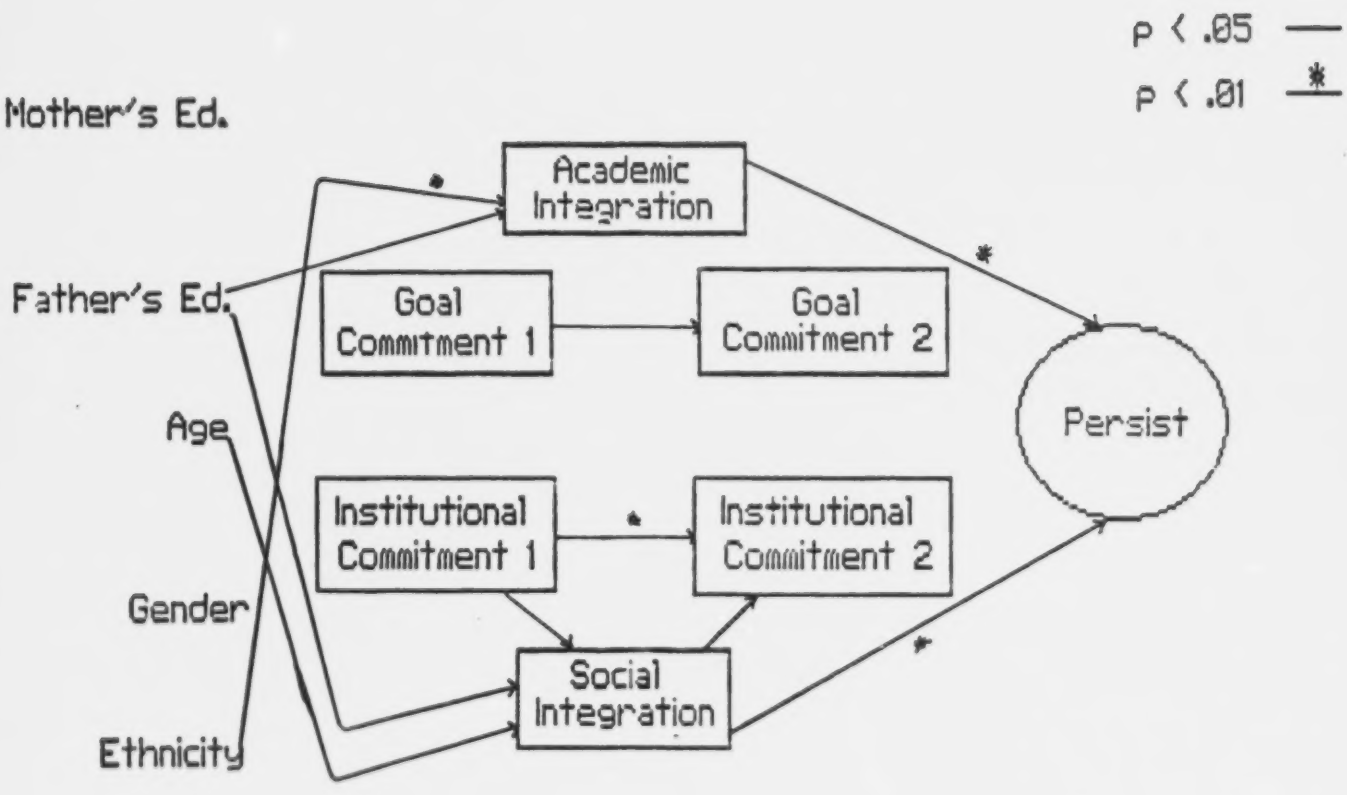

Figure 1 Final Model for the Male Subgroup

related. Social Integration was significantly influenced by Initial Institutional Commitment and significantly influenced Later Institutional Commitment. Only Academic Integration and Social Integration significantly and directly influenced persistence.

Discussion

This study focused only on the characteristics and experiences of a random sample of students who were new fall 1984 freshmen at the focal institution. The influences of the constructs within the Tinto model have been found to vary according to institutional characteristics (Pascarella & Chapman, 1983). Additionally, experience patterns leading to persistence have been found to differ according to class level. Finally, it is possible that some of the students who left the institution may be stopouts, that is, they may re-enroll in the university in the future. For these reasons, results must be interpreted with caution.

Previous persistence studies have found background characteristics comparatively unimportant (Bean, 1980; Pascarella & Terenzini, 1983). It is not surprising then to note that effects of the background characteristics on later constructs within the model were generally the same for both subgroups.

Consistent with previous research (Pascarella & Terenzini, 1983) significant interaction effects were found for one of the groups. For females ethnicity by social integration and ethnicity by academic integration made significant contributions

to the explanation of persistence over and above main effects. Minorities at higher levels of social integration were more likely to drop out. But, minorities at high levels of academic integration were more likely to persist.

These results reinforce Tinto's conjecture that background effects do indeed influence persistence directly. As expected, initial levels of institutional and goal commitments strongly influenced later levels of the same variables. Similarly to previous studies, for both males and females academic and social integration positively, directly and significantly influenced persistence. For females, later institutional commitment also significantly affected persistence.

Methodological Implications

Previous studies have found significant differences between males'and females' persistence patterns within the Tinto model (Pascarella & Terenzini, 1983). Similar differences occurred in the initial models analyzed here. However, when hypothesis testing was employed to determine whether or not paths significantly differed across the two subgroups, only one significant difference was found. Holding initial institutional commitment's influence on social integration equal across the two groups adversely and significantly affected the fit of the model to the data, even though the path was significant for both groups. Such comparisons were not made for the influences on persistence however because that portion of the model was analyzed using logistic regression.

The use of LISREL along with logistic regression avoided

many of the assumption problems that are common grounds for criticism in attrition research. Previous researchers have been criticized for using a highly skewed categorical dependent variable as the final criterion in regression type equations.

LISREL provided for hypothesis testing for significant differences between subgroups. Such differences cannot be analyzed using path analysis. Additionally, through the use of LISREL, one may test the fit of various models to the data and evaluate for significance, thus allowing researchers to make more conclusive statements concerning populations being studied.

Finally, with statistical tools used to analyze data in most persistence studies, once the researcher has specified order, causality and direction among variables in question reciprocal relationships cannot be explored. Techniques employed in most studies assume a recursive or unidirectional model of causal relationships. It may be that the causal linkages are reciprocal rather than unidirectional. It is clear that, through exploration of such influences, the use of LISREL in combination with logistic regression can make a significant impact on attrition research. Additionally, in studies focusing on attrition across four years or among special populations of students where the distribution of dropouts and persisters is closer to 50-50, LISREL may be particularly useful. Higher education researchers examining other relationships among dichotomous, ordinal, and continuous variables using theoretical causal models can use LISREL without the assumption violations typically inherent in such work.

References

Abel, W. (1966). Attrition and the student who is certain. Personnel and Guidance Journal, 44, 1042-45.

Astin, A. (1964). Personal and environmental factors associated with college dropouts among high aptitude students. Journal of Educational Psychology, 55, 218-227.

Bean, J. (1980). Dropouts and turnover: The synthesis and test of a causal model of student attrition. Research in Higher Education, 12, 155-187.

Bean, J. (1985). Interaction effects based on class level in an explanatory model of college student dropout syndrome. American Educational Research Journal, 22, 35-64.

Benin, M. & Johnson, D. (1984). Sibling similarities in educational attainment: A comparison of like-sex and cross-sex sibling pairs. Sociology of Education, 1984, 57, 11-21.

Boshier, R. (1982). Educational Participation Scales. Vancouver: Learning Press.

Boshier, R. & Collins, J. (1982). Educational participation norms and factor structure for thirteen thousand learners. Proceedings of the Adult Education Research Conference (AERC), Lincoln, April, 1982.

Gordon, V. (1982). Reasons for entering college and academic and vocational preferences. Journal of College Student Personnel, 23, 371-377.

Kim, J. & Mueller, C. (1981). Factor Analysis: Statistical Methods and Practical Issues. Beverly Hills: Sage Publications.

Pascarella, E. & Chapmam, E. (1983). A multidimensional, path analytic validation of Tinto's model of college withdrawal. American Educational Research Journal, 20, 87-102.

Pascarella, E. & Terenzini, P. (1979). Interaction effects in Spady's and Tinto's conceptual models of college dropout. Sociology of Education, 52, 197-210.

Pascarella, E. & Terenzini, P. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. Journal of Higher Education, 52, 60-75.

Pascarella, E. & Terenzini, P. (1983). Predicting voluntary freshman year persistence/withdrawal behavior in a residential university: A path analytic validation of the Tinto model. Journal of Educational Psychology, 85, 215-226.

Pascarella, E., Terenzini, P. & Wolfle, L. (1986). Orientation to college and freshman year persistence/withdrawal decisions. Journal of Higher Education, 57, 155-175.

Spady, W. (1970). Dropouts from higher education: An interdisciplinary review and synthesis. Interchange, 1, 64-85, 89-125.

Spady, W. (1971). Dropouts from higher education: Toward an empirical model. Interchange, 2(3), 38-62.

Terenzini, P. & Pascarella, E. (1980). Toward the validation of Tinto's model of college student attrition: A review of recent studies. Research in Higher Education, 12, 271-282.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. Review of Educational Research, 45, 89-125.

Wolfgang, M. & Dowling, W. (1981). Differences in motivation of adult and younger undergraduates. Journal of Higher Education, 52, 640-648.

Wolfle, L. (1985). Postsecondary educational attainment among whites and blacks. American Educational Research Journal, 22, 501-525.